GREEN ROADS

Paving the way with recycled tires.

California Department of Resources Recycling and Recovery

Rubberized Asphalt Concrete

RUBBERIZED ASPHALT CONCRETE

The California Department of Resources Recycling and Recovery, also known as CalRecycle, is dedicated to advancing California's tire waste reduction efforts by promoting the use of tire-derived products.

Rubberized asphalt concrete (RAC) is a road paving material made by blending ground tire rubber with asphalt binder that is then mixed with conventional aggregate materials. This mix can be placed using conventional paving equipment. Road paving projects that use RAC keep thousands of tires per paved mile out of landfills.

Benefits of RAC

1. Cost-Effective

RAC can be used at reduced thickness, which may offset its initial cost increase versus conventional asphalt concrete. In addition, RAC typically has a lower lifecycle cost because of its increased longevity and durability.

2. Long-Lasting and Durable

RAC resists cracking and case studies have demonstrated time and again that RAC lasts much longer than conventional materials—often 50 percent longer. This not only saves on maintenance costs but also cuts down on construction-induced traffic.

3. Noise Reduction

There is a significant reduction in the road noise produced from the tire/pavement interface when using RAC versus conventional pavement overlays.
In most cases, RAC is twice as effective at reducing road noise.

4. Reduces Landfill Disposal

A two-inch thick resurfacing project uses up to 2,000 scrap tires per lane mile. This means that for a one-mile section of a four-lane highway, up to 8,000 waste tires are used in creating longer-lasting roads, instead of ending up in landfills and illegal stockpiles. Thousand Oaks was one of the first California cities to take advantage of RAC, and since 1992 has used more than 1.55 million waste tires in road paving projects.

Project Applications

Crumb rubber from waste tires can be used in various ways in roadway rehabilitation. The most common applications are:

1. Rubberized hot-mix asphalt resurfacing over existing asphalt or concrete pavement (overlay)

2. Rubberized stress absorbing membrane

Resurfacing

RAC can be used in a cost-effective manner as an overlay. Caltrans design guidelines are generally used to determine the thickness of conventional asphalt concrete overlays based on deflection testing. These guidelines indicate a reduction in overlay thickness of up to one-half may be used if RAC is selected, while still providing the same degree of protection against reflective cracking. Studies have indicated RAC also provides a degree of structural strength increase versus conventional asphalt concrete. The minimum recommended thickness for RAC overlays is 1.25 inches.

Stress Absorbing Membrane (Chip Seal)

A rubberized chip seal can be used effectively in cases where the existing roadway is basically sound and all that is needed is a new surface course. The crumb rubber in the asphalt binder provides increased flexibility of the surface which increases resistance to reflective cracking and helps keep the surface water from entering the roadway subgrade.

A chip seal can also be used as stress absorbing membrane interlayer in conjunction with an overlay of conventional asphalt concrete or RAC. The interlayer is best used where the existing roadway section is basically sound but oxidation of the surface asphalt has resulted in mild to severe alligator cracking and additional resistance to reflective cracking is needed.

Manufacturing Process

Currently RAC is specified by the Greenbook, 2009 Edition, Standard Specifications for Public Works Construction and by Caltrans. RAC can be manufactured and placed satisfactorily using either specification.

There are two processes used to add crumb rubber to liquid asphalt cement.

Asphalt-Rubber Process

The asphalt-rubber process is any method that mixes and reacts the rubber particles with the asphalt cement prior to adding the resulting binder to the aggregate. This process has the longest history of use and is the basis for the Caltrans reduced thickness design. Asphalt-rubber is field blended and requires special equipment at the hot-mix plant to react the crumb rubber with the asphalt cement.

Terminal Blend Process

The terminal blend process digests the crumb rubber into the asphalt cement at the refinery (or asphalt terminal). This process has been used in Texas since 1989 and in California since the mid-1990s. The terminal blend process does not require special equipment at the hot-mix plant.

- Typical crumb rubber modifier content for asphalt-rubber ranges from 18-22 percent. The crumb rubber modifier used in asphalt-rubber is in the 10-16 mesh range.

- Terminal blend binders contain 10 percent or less crumb rubber modifier. However, in recent years the crumb rubber modifier content has been increased to 15-20 percent in some projects.

Cost Comparison

In most applications, RAC can be used at a reduced thickness compared to conventional asphalt overlays—in some cases at half the thickness of conventional material—which may result in significant material reduction and cost savings. In addition there may be lifecycle cost savings from the reduction in maintenance costs and longevity of RAC.

- For example, when soil/deflectometer testing indicates that a 4-inch overlay of conventional asphalt concrete is required, RAC saves up to $75,000 per lane mile over conventional asphalt concrete.

Visit **www.PavingGreenRoads.com** and the Rubberized Asphalt Concrete link for more technical information and cost comparisons.

Testimonials

"The City of Thousand Oaks is quite pleased with its experience with RAC. We've been using RAC for nearly two decades and encourage the use of this product in other California cities. If we can see the benefits of RAC, so can you."

Tom Pizza, P.E., Engineering Division Manager, City of Thousand Oaks Construction and Right of Way Management

"The Sacramento County Department of Transportation has had routine use of asphalt rubber since 1990. Since that time, we have placed over a half million tons of asphalt rubber, recycling more than 1.5 million waste tires. We now choose the product from a lifecycle savings and environmental mitigation perspective. We feel that with asphalt rubber's performance in rut and reflective crack resistance, coupled with the longevity, traffic noise reduction and use of a recycled product it's the right choice."

Michael Penrose, Director, County of Sacramento, Department of Transportation

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